GEO-HYDRO, INC
Consulting in Geology and Hydrogeology

1928 E. 14th Avenue
Denver, Colorado 80206
(303) 322-3171

Comments on the Pines Screening Level Ecological Risk Assessment
Prepared by Geo-Hydro Inc. on behalf of
People in Need of Environmental Safety

Geo-Hydro Inc. (GHI) is submitting the following comments on the Screening Level Ecological Risk Assessment (SERA) for the Pines Area of Investigation dated December 2011, on behalf of People In Need of Environmental Safety (PINES). Our general and specific comments on that document are provided below. The comments are designed to identify now the most significant technical issues associated with the SERA. Due to limitations of the budget available to GHI, these comments are not as complete and detailed as one would like at this point. However, GHI will further address these, and lesser, issues with the SERA with PINES as the RIFS process continues and concludes, thereby allowing PINES to fulfill its obligations to the public under the TAP.

General Comments

1. EPA considers risk to be the chance of harmful effects to human health or to ecological systems resulting from exposure to an environmental stressor. Risk assessment is a systematic, scientific approach to characterize the type and magnitude of health risks from chemical contaminants or other stressors. The risk managers use this information to help decide how best to reduce or eliminate risk to receptors (i.e., humans or the environment, including various categories of ecological species from the community to the species level). Risk depends on the following factors:

    a. Contaminant concentrations in site media (soil, sediment, water, air)

    b. The exposure or contact rate of the receptor with contaminated media

    c. How toxic the contaminant(s) are to receptors.

    A well-conducted risk assessment is an important tool for managing risk related to contaminated sites. When many decisions are made during the sampling plan stage that affect the type, location, quantity, and quality of the data collected, an unbiased analysis of the data cannot be made. Potential risk can only be estimated if the dataset is reliable. Decisions in the screening level risk analysis stage to remove contaminants from evaluation also may eliminate or reduce risk inappropriately (although the stated intent may be to “focus” the risk assessment) can it be stated that “focusing” a risk assessment prior to conducting it, thereby potentially underestimating risk, is not an accepted practice or protocol?.

    At Pines, potential risks have been effectively “managed away” prior to the SERA at every step of the process:

    - Use of background data early in the risk assessment process effectively eliminates potential contaminants of concern out of the assessment.

- Use of poorly documented "historic or prior knowledge" to limit the sampling plan, including selection of constituents and sample locations biases the risk assessment inappropriately low. Relying solely on the questionable 'historic' CCB locations makes the risk results more uncertain. A properly designed sampling plan would necessarily have included the biased 'historical' samples and samples of chance stumbled upon, but also randomly selected samples within the area.

- Assuming that the soil samples of chance, collected during installation of water systems, adequately represent soil contamination elsewhere within the Area of Investigation is unsupported.

- Exposure was only evaluated for terrestrial receptors where it was believed CCBs were placed. This limits the quality of the risk assessments in direct relation to the quality of both the documentation and knowledge of historic placement of CCBs. Thus, calculated exposure for terrestrial receptors is potentially underestimated and is highly uncertain.

- Assuming that visual inspection of soils and sediments is completely effective for identifying areas of CCB contamination, or of areas where metals or other inorganics migrated from CCBs into surrounding media is unsupported. Note that there has been no confirmation sampling or statistical analysis of data to develop a relationship between visual inspection and contaminant concentrations. The reader is led to believe that the method is 100% effective without any evidence to support the assumption.

2. Hydrochemical processes are in operation within the Area of Investigation that leave the maximum concentration of various CCB-related contaminants unidentified in the Remedial Investigation and, as a result, the SERA uses speculative values. Processes of concern include:

   - Concentrations of CCB-related contaminants in groundwater may increase over time due to the mounded leachate within Yard 520 that was observed during the Remedial Investigation, particularly as the CCBs continue to weather and chemically evolve. Increasing leachate head within the landfill would have the effect of driving yet more leachate outward in all directions and increasing concentrations of CCB-related contaminants in groundwater. Since groundwater moves very slowly, it will take some time for the eventual maximum concentration of CCB-related contaminants to be detected in area wells.

   - It is not by chance that maximum concentrations of many CCB-related contaminants in Brown Ditch sediment (Table 4-1) were found at location SW022. Monitoring point SW022 is located immediately south of the Yard 520 Landfill, in an area of discharging groundwater contaminated with CCB constituents. Contaminants transported to the stream in groundwater flow encounter changed geochemical conditions at the stream bottom that cause contaminants to precipitate from solution or be attenuated in sediment, thus increasing concentrations in sediment. This process continues and concentration continues to increase until such time that a storm event mobilizes the sediment and it is transported further downstream to a slack-water environment such as the wetlands of the Indiana Dunes National Lakeshore (IDNL). Once flow velocities subside, new sediment is deposited on the stream bottom at SW022 and the process repeats. Because of this process is cyclic, the concentration of CCB-related contaminants in Brown Ditch sediments in the vicinity of Yard 520 is partially dependent on the time since that last sediment-mobilizing storm event. A long time period between mobilizing flow events and will correspond to higher contaminant concentrations. Since the time between sampling and major flow events has not been evaluated, the maximum concentration of CCB-related contaminants that might be present in sediments during extended dry periods has not been identified.

- Arsenic (and other contaminants) attenuation from groundwater is directly offset by increased concentration in the attenuating soils. This was previously raised with respect to arsenic in the course of the RI and USEPA directed the PRPs to look for such zones of concentration in soils. The PRPs looked in areas predictably unlikely, or impossibly, in the path(s) of migration and, as would be expected, found no samples with sequestered arsenic. It is KNOWN that the arsenic is being attenuated under today's hydrochemical system. The PRPs identified areas where the attenuation is NOT occurring, but not where it is occurring. Since arsenic sequestration by adsorption can reach concentrations of percentages in iron-rich sediments, this is not a trivial issue. Future subtle changes in water quality in the migration path can remobilize sequestered arsenic, from a soil that has orders of magnitude higher concentrations than the original CCB.

3. Sampling in the area of investigation was largely driven by visual inspection. This was termed the CCB visual inspection program. Sampling derived by visual inspection was not verified by chemical or petrographic analysis of randomly selected samples for the accuracy of this technique. The details of the visual inspection system are not spelled out in the ERA, but it would seem logical that areas of CCB placement could have been missed if leaf litter or other organic matter was deposited on top of CCBs, or if top soils or fill material were placed on top of CCBs. Unless a grid was established, and soil cores collected at pre-determined intervals, in addition to visual observations in order to determine the accuracy of visual inspection, the visual inspection data must be considered highly uncertain and unscientific.

4. Soil samples collected during the installation of the water delivery system are samples of chance, and do not represent a well-designed sampling program or a surrogate for such a sampling program. For terrestrial sampling, section 3.2.3, it states that habitat evaluation was based on prior knowledge of the historic placement of CCBs. Prior knowledge appears to be anecdotal evidence, and is very poorly documented when documented at all.

5. The field or habitat investigation focused on a windshield survey and additional observations at eight locations in less populated areas. An additional consideration that affected the habitat evaluation was “knowledge” of confirmed or suspected CCBs, which as stated in comment three above, is highly uncertain. Habitat within the entire area of investigation was not evaluated. There are extensive high quality habitats in the surrounding area, including the IDNL, numerous wetlands and drainages, and freshwater lakes. The report acknowledges that part of the Area of Investigation falls within the IDNL. The habitat evaluation is potentially biased, and statements that suggest habitat in the area is not worth protecting are misleading.

6. Although it states that qualified ecologists performed the habitat evaluation, it does not indicate whether or not vegetation was visibly different in areas of known CCP contamination compared to undisturbed areas. It is quite possible that plants that are tolerant of metals would tend to be more successful in areas with CCB contamination. The plant communities therefore could be different and should have been documented, if only as a potential verification or refutation of the 'historical' reports.

7. The ERA is not transparent. Tables containing complete summary statistics should be provided, including sample size, minimum and maximum detected values, minimum and maximum reporting limits, detection frequency, and number of detected values and reporting limits that exceed screening levels. Data for all target analytes should be reviewed, including those that were eliminated in the RI since the RI is not the appropriate place to perform risk management decisions. This means that PAHs and dioxins should also be presented and risk evaluated herein, as well as any other analytes that may occur in CCBs that have been dropped prior to the risk assessment.

8. The "refinement" steps (Tables 5-20 to 5-30) included in this screening level analysis are more appropriately included in a baseline risk assessment. A SERA by definition is intended to be conservative and conducted with limited data, conservative estimates of exposure, and conservative or upper bound estimates on all exposure parameters. If HQs under these conditions are below 1, the risk managers can be reasonably certain that there are no significant ecological effects and ecological risk does not need to be addressed further. However, given the proximity to the IDNL, and sensitive habitats and species contained therein, this SERA should have terminated with comparison to screening levels. All COPECs should be carried forward. Additional data collection to remove data gaps, including development of toxicological reference values for birds and mammals, and collection of data to "refine" exposure to reflect site-specific conditions, should be presented in the baseline report.

9. The Yard 520 sample results should be included in the SERA since it is unknown if pockets of pure uncontrolled CCBs exist in the site area and may be contacted by ecological receptors. If evidence is not available to technically demonstrate that the trench samples contain 100% CCBs, then the Yard 520 samples provide the only conservative upper-bound on exposure for at least that form of CCB. This upper-bound concentration of Yard 520 CCBs, and perhaps other forms of CCB, is lacking from this report.

Specific Comments

1. Section 3.3, page 3-9 – This section states that impacts of groundwater flowing into Brown Ditch were evaluated by comparing against sediment benchmarks derived to be protective of plants, as available. Section 3.3.2 elaborates on this approach. Soil benchmarks for plants also should have been used, and the lower of the sediment or soil benchmark applied in the ERA – it appears from later statements on page 3-13 that this was in fact the case, and if so, the text on 3-9 should

be clarified. Groundwater data should also have been compared directly to surface water criteria protective of aquatic life, and not just plants, for the risk assessment. This is because it is the dissolved form of the constituents that is the most toxic to plants, aquatic, or benthic life. Groundwater would be carrying a dissolved load, and sediment pore water would contain higher concentrations than the overlying surface water where dilution had already occurred. This would have allowed for identifying areas of potential groundwater-surface water interaction, and verifying that sufficient sediment and surface water samples were collected in the appropriate locations, and that concentrations in sediment and surface water were below appropriate ecological benchmarks.

2. Page 3-11 (first paragraph) - Review of the text and the tables from Sections 3 and 4, indicates that incidental ingestion of soil and sediments for birds and mammals is considered in the screening level ERA (SERA). However, review of the tables indicates that not all COPECs were actually evaluated. Initial screening steps to ecological screening values (Table 3-9) are based only on plants and invertebrates. Ecological screening values for birds and mammals are not reported in Table 3-9, and thus it must be assumed that they were not considered. This is not standard practice, and will eliminate COPECs from evaluation for potential risks to higher trophic level wildlife, and bias risk results low. For example, aluminum is screened out as a soil COPC (Table 4-8) on the basis of pH and toxicity to soil fauna and is not shown as a COPEC in Table 5-28; however, birds and mammals should also be considered. Barium is retained as a COPEC in Table 4-8, yet barium is not listed on Table 5-28 as a terrestrial COPEC. Birds and mammals may be more sensitive to certain constituents than plants or invertebrates. If screening levels for birds and mammals aren't utilized in the SERA, contaminants of potential concern are eliminated from the risk assessment. Exposure to birds and mammals results from more than just dietary ingestion or intentional grit consumption. Incidental sediment or soil ingestion during foraging or other behaviors (i.e., grooming, burrowing) is a potentially complete exposure pathway that should not be neglected for evaluation for all target analytes as part of the process of selecting COPECs.

3. Page 3-12 (first bullet) - The statement that the zone of highest biological activity for soil-dwelling ecological receptors is the top 1-foot is erroneous for anything other than small invertebrates. Furthermore, soil horizons are not permanent, but may change over time due to erosion, human activities, or burrowing activities of ecological receptors. Earthworms, ants, and other invertebrate macrofauna commonly migrate vertically through the soil profile to depths of much more than 1 foot. Burrowing animals dig much deeper than 1 foot. One foot is certainly not at all deep for plant roots. Surface soils and subsurface soils should have been evaluated separately in the ERA as different receptors contact different soil depths. Evaluating surface soils and subsurface soils separately also would have allowed risk managers to understand the potential risks if activities of burrowing mammals or invertebrates mix surface and subsurface soils, and also evaluate potential risks in the event that soils are disturbed during future excavation activities.

4. Page 3-12 - The ERA describes the target analyte list for the samples collected under the RI. Dioxins and PAHs were not evaluated because prior sampling at Yard 520 had eliminated these constituents as potential COPCs. The number of samples that were collected in Yard 520 and analyzed for PAHs and dioxins should be mentioned here, as well as the reporting limits, number of detected values, and minimum and maximum detections. This would allow a reader to understand whether the target analyte list is appropriate for evaluating potential ecological risk at the site.

5. Page 3 – 14 (first paragraph) - The ERA states that Brown Ditch sediment data were evaluated to assess potential for impacts to the wetland plant community as representative of hydric soils. Some analysis of this assumption should be provided to support the results. For instance, is it reasonable to assume that sediments and soils are similar by comparing sediment and soil data? Would it be more conservative to use the surface and subsurface soil data in addition to sediment data in order to determine potential risk to wetland receptors? In addition, do decisions that were made during the sampling program bias the soil and sediment sampling results? If visual inspection was used to guide the Brown Ditch sampling program for sediments, is it logical to assume that soil away from Brown Ditch has similar concentrations of CCBs? Wouldn't CCBs have been placed into shallow depressions, and even if overgrown with wetland vegetation and not visible, be present as an exposure point for wetland receptors?

6. Section 3.6 - It is not clear from the potential exposure pathways identified in the ecological conceptual site model whether the potential for migration of CCB constituents into the IDNL was considered by sampling. The statements that only the Brown ditch system and adjacent man-made ponds and basins were considered as part of exposure pathways suggest that off-site migration or sampling in the Area of Investigation that intersects with the IDNL was not quantitatively evaluated. The text should be clarified and, if the SERA does not address off-site transport and deposition with concomitant exposure, the SERA should be revised to do so.

7. Section 3.7 – This section describes how the target analyte list is refined to a smaller list of contaminants of potential ecological concern. From review of previous documents it does not appear that the initial target analyte list was comprehensive, meaning that many inorganics that could be components of CCBs were lacking, and if sampled, were only sampled in certain media. This includes mercury, a bioaccumulative and toxic constituent commonly associated with coal-fired power plants and CCBs. If the blanks on Table 4-7 are indicative of missing information, many other analytes were not sampled in each medium of concern. This means that the COPEC list is also incomplete. This is another example of how allowing presumptions of lack of risk to manage data acquisition at an early stage of the process can bias the risk assessment results low and make the resulting document unacceptable for decision-making purposes (please refer to general comment 1).

8. Page 3-17 (second bullet) – The ERA states that background values were applied if no toxicity-based value could be identified. *Use of background at the screening step is not appropriate and is not standard practice.* It is particularly egregious when the investigation presumes visual examination is adequate to discriminate between background and waste sediments. Instead, the analyte should be carried forward and addressed in the uncertainty analysis and compared to site background at the end of the risk characterization. Use of the sediment hierarchy described in the document implies that one source of sediment benchmarks is preferable to another. The reasoning behind this should be described in the ERA. There are other sources of sediment quality benchmarks that could have been considered in addition to those listed and it would be helpful to state why these other documents were not used. It is possible that some of them could have provided more conservative values than the values used in the analysis. Given the uncertainty involved in the sediment quality benchmarks, the heterogeneity in sediment concentrations, the variability between the communities, and the general uncertainty involved with addressing sediment toxicity in the absence of site specific sediment toxicity tests or benthic population analysis, a more appropriate approach would have been to use the lowest available sediment quality benchmark from the various sources.

9. Page 3-17 - Discussion of the boron surface water screening value. The Region 4 criterion is also found on the ecological benchmark tool. Similar to concerns with sediment quality criteria discussed above, an analysis of why this hierarchy is preferable as opposed to using the lowest value from the available listed sources should be provided. Is there scientific evidence to indicate that the Region 5 screening level is preferable to Region 4 (i.e., what is the underlying basis of the screening level)? If not, in the absence of a national water quality criterion or an Indiana water quality criterion, the lowest of available values should be applied. Applying a hierarchy indicates that one source is more technically defensible than another. If this is not true, it introduces additional uncertainty into the risk assessment results and can serve to make the analysis less conservative and unreliable.

10. Page 3-17 (bottom of page) – The discussion regarding application of AWQC to groundwater concentrations for evaluation of potential ecological risks appears to conflict with earlier statements regarding how groundwater was addressed in the risk assessment. For example, Section 3.3, 3rd paragraph, page 3-9, states that groundwater impacts on aquatic receptors will be addressed with surface water data. Please check the text for consistency and clarity. Earlier statements indicated that groundwater was not compared to surface water screening values in the screening level risk assessment.

11. Page 3-18, Section 3.7.3 - The soil screening level hierarchy should be justified as described above for sediment and surface water. If there is not an eco-SSL, the lowest of the available values should be used unless there is good reason to use the hierarchical approach. The Dutch Intervention Values are levels at which there is 50% or more mortality in ecological receptors. This is not an allowable screening level and if these values are used they should be divided by

uncertainty factors prior to use as screening levels. The screening level concept is supposed to be conservative, used with minimal data, and allowing analytes to be carried forward in a baseline risk assessment if appropriate. *Use of values at which mortality is evident is not acceptable in the screening level process.* The revised statement indicates that the Dutch EIVs were not used, however the bullet was not deleted and it should be, for the reasons stated above.

12. Page 3-18, Section 3.7.5 - Comparison to background should not be made in the screening level risk assessment. All analytes that exceed screening values should be carried forward into a baseline risk assessment. Comparison to background should not be made until the risk characterization phase a baseline risk assessment. While the comparison to background evaluation was at one time performed earlier in the process this is no longer the case. *It is considered standard practice by risk assessors within the different EPA regions to defer comparison to background to the final stages of the baseline risk assessment report.* The reasoning behind this is that the screening level risk assessment may be performed on a limited data set, and lead to the identification of data gaps and additional data collection. The screening level risk assessment is supposed to be conservative. The full evaluation of risks in the baseline risk assessment is required so that the risk managers understand the potential for harm to the environment. Once the risks have been fully evaluated, comparison to background can be made prior to arriving at the baseline risk assessment conclusions. Otherwise a hazard index, which is the sum of the various hazard quotients across multiple analytes that have a similar toxicological effect, may be seriously underestimated by removal of analytes that are at or below background. This in turn could affect remedial decisions or even hot spot removal. This does not mean that analytes that are at or below background would drive a remedial decision, only that a full understanding of site conditions is necessary to make appropriate remedial decisions. It may be that additional data gaps are identified as part of the risk assessment process that would need to be rectified prior to moving forward into the feasibility study. The effect of Section 3.7.5 therefore reduces the list of COPECs evaluated in the baseline risk assessment and biases the risk results low in the baseline analysis.

13. Page 4-1, Section 4.1 - The text describes the identification of the COPEC's and notes that nondetected analytes were not included in the screening level evaluation. At this point it should also provide an analysis of the reporting limits. If the reporting limits exceeded screening values, the data are inadequate to perform risk assessment for these analytes. Matrix interferences can sometimes elevate only certain samples such that the data are not detected but the reporting limit is very high. These samples should be retained in the risk assessment at a surrogate value of one half the detection limit or by noting in ProUCL that it is nondetected. Locations where the reporting limits are elevated may indicate a hot spot. The hot spots should be evaluated particularly given the site history and the way that CCBs could occur in the environment. The nondetects should be discussed in the uncertainty analysis. By removing the nondetects from the database the analysis artificially biases the risks low. The last subsection of 4.1 is misleading in that it states that the identification of COPECs reflects constituent exposure

pathways that warrant further evaluation. The numerous steps taken to minimize calculated risk to this point in the analysis mean that the number of COPECs is grossly underestimated and many risks in different exposure pathways may have been overlooked.

14. Page 4-4 - The text indicates background comparison was not performed due to an insufficient number of samples for some constituents. It is not clear why all samples were not analyzed for all constituents. If this is due to detection frequency, an analysis of the reporting limits should be provided to help identify hotspots.

15. Table 4-6 - Mercury appears to have only been sampled in soil. The mercury ESV is shown as 0.1 mg/kg; this is a value that is protective of invertebrates. The Oak Ridge National Laboratory Preliminary Remedial Goals document provides a value of 0.00051 mg/kg for birds. If the lower value had been used, mercury would not have passed the screening evaluation.

16. Table 4-6. Note that unless it can be verified that the soil samples were 100% CCBs, the table title is misleading and would more appropriately be labeled soils. This could have biased the sampling data as well, since in Section 4.2 it states that mercury was not analyzed in sediment or surface water because it was low in “suspected” CCBs. If in fact these soil samples were only partially CCB material, mercury concentrations were biased low. If the suspected CCBs were of a single CCB type, e.g. only bottom ash or only fly ash, low Hg would not be indicative of all CCBs. Furthermore, because it is bioaccumulative, concentrations protective only of plants and invertebrates are not sufficient to protect against food chain contamination. In addition, because mercury tends to methylate in aquatic systems, the lack of mercury data introduces a large data gap for evaluation of potential aquatic or wetland risks to ecological receptors or to humans eating fish.

17. Section 4.2.1 – This section documents the selection of representative species for the ERA. There appears to be a tendency to select the largest receptors to represent each of the feeding categories. This will underestimate potential risks for smaller receptors that have more limited mobility and smaller home ranges. In addition, smaller animals have higher metabolic rates. This means that they eat and drink relatively more than their larger counterparts. The result, of utilizing these larger receptors in the ERA is to bias risk results low. This means that the risk assessment will not be protective of smaller species in the ecosystem. Because smaller animals tend to be more abundant than larger animals, this indicates that the risk assessment would not be protective of most of the animals in the area. Other, more preferable, receptors that fit into each of the feeding categories live in the Area of Investigation. For example,

    a. Instead of the mallard, a smaller dabbling duck such as a blue-winged teal, or a wood duck should have been used.

b. Instead of the green heron, a smaller shorebird such as one of the sandpipers should have been used. Instead of the muskrat, a smaller herbivorous mammal common to the aquatic ecosystem such as a meadow vole should have been selected.

c. A raccoon (typical body weight of 8 to 20 pounds) should not be considered a small animal, and the text is inconsistent by calling it a small mammal in the first sentence and a medium-sized omnivore in the second sentence. A deer mouse or white-footed mouse (body weight less than 1 oz) is a small omnivore that should have been used in the terrestrial and aquatic ecosystems, as they would be expected to forage along the ditch or stream banks just as a raccoon would.

d. The Canada goose is undoubtedly the largest bird that could have been selected as an avian herbivore. There are upland game birds such as quail, and herbivorous songbirds such as chickadees, that would be expected to occur in the area and provide a more conservative estimate of exposure. Bobwhite quail are important in Indiana's upland game management plan and would therefore also be a species of interest just as the Canada goose is.

e. The American Robin is not an insectivore. It is known to eat a wide variety of food items, including fruits and berries, as well as invertebrates. Approximately 50% of the robins' diet is fruit or berries, making it omnivorous and not insectivorous. Birds that eat primarily insects are the swifts, swallows, warblers, and flycatchers. A species in one of these families should have been selected.

f. The Red-tailed Hawk is a large raptor. Exposure for a bird this size would not be representative of smaller raptors that would be expected in the area such as screech owls or kestrels.

18. Section 4.2.2 – This section states that soils from depths up to 5 feet were used to evaluate surface soil exposure in the food chain model. This does not seem consistent with earlier statements that soils of depths up to 1 foot were used. The text should be revised for clarity and consistency. Depths up to 5 feet cannot be considered surface soil. Surface soil and subsurface soil should be evaluated separately.

19. Section 4.2.2.1 – This section discusses the exposure assumptions and parameters for the various receptors. It states that grit exposure was evaluated for three of the avian species. It is unclear if incidental soil ingestion was evaluated in addition to the dietary ingestion pathway. All animals potentially ingest soil or sediments as part of foraging and feeding, as well as grooming and preening behaviors. To only evaluate grit ingestion for the three species mentioned underestimates potential exposure. For instance, shorebirds would be expected to ingest high levels of sediment during probing as well as the sediment that is in the gut of the prey items they ingest.

20. Section 5.4 - There are many statements regarding the “conservative” nature of the ERA. This review points out many assumptions and methods in the ERA that result in a sum that is not a conservative estimate of risk.

21. Section 5.4.1, page 5-14 – The discussion of uncertainty associated with the site characterization describes uncertainty related to characterization as being overly conservative because the entire area is not underlain by “Suspected CCB”. This description ignores the fact that the suspected CCB’s used in the SERA are composed of undetermined amounts of native soils or other non-CCB materials and may therefore underestimate ecological risks in locations where 100% CCB has been disposed. The description further ignores the reality that not all CCBs are equally dangerous and there has been no characterization of sub-groups within the “Suspected CCB.” At a minimum, analytical results from samples of CCB obtained from the Yard 520 sampling program should be evaluated to provide a conservative evaluation of risks to ecological receptors exposed to areas filled with CCB comparable to that sampled from that disposal unit.

22. Section 5.4.1, page 5-15 -The uncertainty analysis claims that a review of groundwater elevation contours over the course of the RI showed no dramatic changes in elevations across the seasons sampled during the RI. This statement is incorrect and misleading. First, while the data included on Table 2-8 shows generally low variations of head levels from any individual well, even those changes represent significant variations in an area of low lateral gradients. Further, that data shows variations that are not completely consistent with generally anticipated seasonal variation and variable vertical gradients. All of these are significant and need be understood and addressed before generalized platitudes regarding groundwater flow are offered. Finally, the data demonstrate that leachate elevation in piezometer PZ001 increased by 3.39 feet during the four quarters of RI sampling. The piezometer was quickly abandoned following RI data, precluding collection of additional data. Development of a leachate mound within the Yard 520 landfill will drive greater flow from the landfill and result in increased future concentrations of CCB-related contaminants in area wells.

23. Section 6.0 - The conclusions are in error. The surface water quality should be further addressed. For all analytes for which federal or state surface water criteria are exceeded (i.e., HQ>1), additional evaluation is required by regulation as follows, and additional ARARs not repeated below are pertinent as well:

    Indiana Article 2. Water Quality Standards. 327 IAC 2-1-2 Maintenance of surface water quality standards. Authority: IC 13-14-8; IC 13-14-9; IC 13-18-3. Affected: IC 13-18-1; IC 13-18-4; IC 13-30-2-1. Sec. 2. The following policies of nondegradation are applicable to all surface waters of the state: (1) For all waters of the state, existing beneficial uses shall be maintained and protected. No degradation of water quality shall be permitted which would interfere with or become injurious to existing and potential uses. (2) All waters whose existing quality exceeds the standards established herein as of February 17, 1977, shall be maintained in *their present high quality unless and until it is affirmatively demonstrated to the commissioner that limited degradation of such waters is justifiable on the basis of necessary economic or social factors and will not interfere with or become injurious to any beneficial uses made of, or presently possible, in such waters. In making a final determination under this subdivision, the commissioner shall give appropriate consideration to public participation and intergovernmental coordination.*

327 IAC 2-1-6 Minimum surface water quality standards. Authority: IC 13-14-8; IC 13-14-9; IC 13-18-3. Affected: IC 13-11-2-258; IC 13-18-4; IC 13-30-2-1; IC 14-22-9. Sec. 6. (a) The following are minimum surface water quality conditions: (1) All surface waters at all times and at all places, including waters within the mixing zone, shall meet the minimum conditions of being free from substances, materials, floating debris, oil, or scum attributable to municipal, industrial, agricultural, and other land use practices, or other discharges that do any of the following:… (2) At all times, all surface waters outside of mixing zones shall be free of substances in concentrations that on the basis of available scientific data are believed to be sufficient to injure, be chronically toxic to, or be carcinogenic, mutagenic, or teratogenic to humans, animals, aquatic life, or plants. To assure protection against the adverse effects identified in this subdivision, the following requirements are established: (A) A toxic substance or pollutant shall not be present in such waters in concentrations that exceed the most stringent of the following continuous criterion concentrations (CCCs): (i) A chronic aquatic criterion (CAC) to protect aquatic life from chronic toxic effects.(ii) A terrestrial life cycle safe concentration (TLCS) to protect terrestrial organisms from toxic effects that may result from the consumption of aquatic organisms or water from the waterbody. (iii) A human life cycle safe concentration (HLCS) to protect human health from toxic effects that may result from the consumption of aquatic organisms or drinking water from the waterbody.(iv) For carcinogenic substances, a criterion to protect human health from unacceptable cancer risk of greater than one (1) additional occurrence of cancer per one hundred thousand (100,000) population. www.in.gov/legislative/iac/T03270/A00020.PDF

24. Section 6.0 - The conclusions regarding the terrestrial ecosystem are also misleading. While CCBs may comprise only a fraction of the soils within the Area of Investigation, the RI made clear that the soil samples were not necessarily 100% CCB material. This would underestimate the exposure point concentrations in area where 100% CCB material is located.

25. The risk characterization and uncertainty analysis should not be used to eliminate the site from further evaluation. For example, Section 5.4.6 describes how the refinement of COPECs at the screening level presents a more site-specific evaluation of risks to wildlife, suggesting that the procedures followed enhanced the risk assessment as a decision-making tool. In fact, risks may have been underestimated by this approach (See specific comment 2). The uncertainty analysis attempts to rationalize away the potential risk to the muskrat (page 5-45, first paragraph) by stating that soluble forms of aluminum are not present in sediments. However, environmental

solubility is not the concern if the bulk of the dose is due to sediment ingestion because solubility of aluminum is expected to change in the acidic conditions of the mammalian stomach. Because HQs (page 5-47) exceed 1 in the screening level analysis, additional data should be collected to refine EPCs and to fill data gaps, and a baseline risk assessment should be performed. Instead of acknowledging this need, the SERA attempts to rationalize going no further in the assessment.

26. An independent review of the data performed by GHI (Exhibit A) indicates that there are HQs above 1 for the COPECs and therefore, a baseline risk assessment is warranted.

EXHIBIT A
INDEPENDENT ECOLOGICAL RISK ASSESSMENT FOR PINES, INDIANA

1.0 INTRODUCTION

An independent review of the Screening Level Ecological Risk Assessment (SERA) results was performed with the existing data to identify errors and to determine what the results would be using standard practice. Errors in data collection cannot be rectified, and the existing data had to be utilized. Therefore, inadequacies and uncertainties in the selection of sampling locations and target analyte lists are not addressed.

2.0 METHODOLOGY

2.1 Surface Water Data Analysis

The data were reorganized in order to perform statistical evaluation. All samples with a "U" or a "UJ" were counted as not detected. More elaborate coding was not performed because the intent of this effort was to perform a rapid quality control check on the results, and not to perform an in-depth risk assessment. The maximum concentration of each analyte in each medium was compared to medium-specific screening levels. The data are presented in Tables 1 and 2.

Total cadmium (Cd), chromium (Cr), nickel (Ni), and thallium (Tl) were below reporting limits (i.e., not detected) in any background or site sample. The total data were compared to total recoverable chronic criteria for the protection of aquatic life (AWQC) from the USEPA (http://water.epa.gov/scitech/swguidance/standards/current/upload/nrwqc-2009.pdf). The USEPA criteria are typically expressed in terms of dissolved metals in water and must be divided by a conversion factor in order to compare to total recoverable data. The minimum site hardness was applied to the hardness dependent metals, and a water effects ratio (WER) of 1 was assumed. Note that application of the AWQC as screening values does not account for bioconcentration in the aquatic food web, and therefore for bioaccumulative analytes this method is not conservative. All bioaccumulative analytes should be retained for evaluation in a baseline ERA.

The data were also reviewed by plotting by location to identify potential patterns. The maximum reported concentration in surface water at each location and the minimum reported total hardness are presented in Figure 1 on a logarithmic scale. The log scale serves to compress the data so that a wider range of concentrations may be more readily compared. If the data were not detected, the reporting limit was used as the surrogate for plotting the information.

2.2 Sediment

The data were reorganized in order to perform statistical evaluation. All samples with a "U" or a "UJ" were counted as not detected. More elaborate coding was not performed because the intent of this effort was to perform a rapid quality control check on the SERA results, and not to perform an in-depth independent risk assessment. The maximum concentration of each analyte in each medium was compared to the minimum medium-specific screening level available from the Ecological Risk Assessment Benchmark Tool (http://rais.ornl.gov/tools/eco_search.php). This includes the Region 5 values, but also additional information. Background was not used to remove analytes, and no hierarchy was applied due to the uncertain nature of sediment risk assessment.

The sediment analytical data are presented in Table 3. Locations SW001 – SW007 were classified as background or upgradient samples assuming that location identifications would be similar to surface water. The remaining sediment samples were considered to be site related.

2.3 Soil

The Yard 520 soil data and the suspected CCBs collected from the trench samples were reviewed. Table 4 presents the Yard 520 data compared to the minimum soil screening level from the Ecological Benchmark Tool. This was used in lieu of the stated hierarchy because there was no evidence that the sources selected were more technically defensible, with the exception of the EcoSSLs which are rigorously peer reviewed. Table 5 presents the trench soil samples compared to the minimum soil screening level from the Ecological Benchmark Tool.

3.0 RESULTS

3.1 Surface Water

A summary of the available surface water data is provided in Table 1 for data on a total recoverable basis. Complete summary statistics are not provided because the intent of this effort is to perform a quality assessment of the data and determine the accuracy of the results. Table 2 summarizes the data for dissolved metals. In each of these tables, the maximum concentration is compared to the U.S. EPA AWQC. Data for total metals are compared to criteria for total metals, and data for dissolved metals are compared to criteria for dissolved metals. The conclusions indicate the analytes status; if below the AWQC the conclusion states “<SL”, and if above the AWQC it states “COPEC”. If an AWQC was not available, the conclusions indicate the analyte is a COPEC because there is “No SL”. If the analyte was not detected in site or background samples, the table indicates “All ND” in the conclusions. If the analyte was not detected but the reporting limits exceeded the screening level, the conclusions show that the analyte is a COPEC and that “RLs>SL”.

Numerous analyte concentrations increase in a downgradient direction in Brown Ditch relative to upgradient concentrations (Figure 1). This indicates a potential source for certain constituents. Other analytes are also elevated in certain background samples. Given the uncertainty in historic knowledge of placement of CCB material, this brings into question the representativeness of SW 004, SW005, and SW006 as background. Additional sampling and statistical evaluation should be performed to determine if these samples truly represent ambient conditions. In addition, there appears to be an outlier at SW018 for manganese.

3.2 Sediment

Nearly all analytes in sediment exceeded the minimum screening value from the Ecological Benchmark Tool, or would be carried forward because a sediment quality benchmark was lacking. It is particularly noteworthy that more samples within the site exceeded screening levels than in the background area.

Sediment should be further evaluated in a baseline risk assessment. Mercury should be analyzed in sediment. Measurement of field populations of benthic invertebrates, in conjunction with laboratory toxicity testing, should be considered prior to eliminating sediments as not being of concern on the basis of benchmark values.

3.3 Soil

There were only four samples that analyzed metals from Yard 520. Mercury ranged from 0.04 to 0.29 mg/kg in these samples. The Region 5 ecological soil screening level for mercury is 0.1 mg/kg. Concentrations of mercury were elevated in soil samples and should be investigated further. Many of the analytes in the Yard 520 CCBs are elevated above soil screening levels. Analytes for which the maximum concentrations exceed screening values should be evaluated in a baseline risk assessment.

There were 37 trench samples collected from within the site and 13 samples that were labeled “native” which were treated like background for this analysis. However, it is recommended that a more rigorous evaluation of these data be conducted to verify that they meet the conditions of representing unimpacted soils and representing ambient conditions. For the purposes of this review, it was accepted that the samples were “native” soils.

Nearly every analyte exceeded ecological soil screening levels. Nearly all analytes associated with the site exceeded native soil concentrations. Therefore, nearly all analytes would be considered COPECs for further evaluation. In addition, screening values were frequently lacking for birds and mammals, and thus all of these analytes should be carried forward into a baseline risk assessment, adequate toxicity information for birds and mammals obtained, and potential risks evaluated for exposure to all COPECs.

3.4 Groundwater

Groundwater was not re-evaluated as part of this effort.

4.0 Conclusions

4.1 Surface Water

All COPECs must be carried forward into a baseline risk assessment, and any data gaps addressed by additional sampling. The surface water COPECs include:

- aluminum,
- barium,
- boron,
- cadmium,

- copper,
- iron,
- manganese,
- molybdenum,
- selenium,
- strontium,
- thallium, and
- vanadium.

Effort should be made to reduce the reporting limits that exceed screening levels, such as for cadmium. Mercury should be analyzed in surface water because this is a data gap. Sampling should include locations in the IDNL if lacking. Additional samples should be collected in the vicinity of SW022 through SW026 because these areas seem to be elevated above background suggesting additional source material.

4.2 Sediment

The conclusions in this evaluation conflict with those in the SERA. Maximum concentrations for samples from the site exceeded those identified as background for every analyte. All of the COPECs had more samples that exceeded the SQC for site sediment sampling than in background areas, suggesting that there are impacts in the site area. Comparison to background should not be made in the screening steps.

Different SQCs were used than in the SERA because there is no technically justifiable basis for the sediment hierarchy proposed in the SERA. Sediments by nature are variable in concentrations. Because toxicity is dependent on site physical properties such as particle size, and also species composition for the benthic community, addressing sediment quality is difficult. Conservative assumptions should be made in the absence of site specific data. Additional data collection including population data and laboratory toxicity tests would be beneficial in determining if an adverse effect was occurring.

4.3 Soil

The conclusions in this brief evaluation conflict with those in the SERA that concludes that no further investigation is necessary. Yard 520 CCB and trench soil samples exceeded the soil screening level for numerous analytes, and therefore these should be considered COPECs. Often, the CCB samples were hundreds of times higher than screening levels expected to correlate with an absence of adverse effects. Soils should be carried forward as a medium of concern. Additional sampling in a randomized grid pattern to verify the conclusions of the “visual inspection” information collected during the installation of water supply systems would be beneficial. UCL95 exposure point concentrations for Yard 520 CCBs, the trench CCBs, and the “native” soil samples should be calculated separately and carried forward into the baseline risk assessment. In addition, a quantitative approach to comparing the Yard 520 CCB concentrations to the trench CCB concentrations should be included to determine a conservative scenario for plants and animals that might burrow through or otherwise contact pockets of pure CCBs that are not included in the Yard 520 cap. Additional data collection should consider measurement of tissue concentrations, laboratory plant and invertebrate toxicity tests, and collection of field population data to use as additional lines of evidence.

Box and whisker plots or other statistical techniques should be used to determine if COPECs are similar to or elevated above background, and where. Due to the uncertainty in site knowledge, outliers should not be eliminated but addressed as potential hot spots and considered for removal in the Feasibility Study to follow.

Table 6 presents all the benchmarks obtained from the Ecological Benchmark Tool. It is apparent that values for higher trophic levels are lacking. These should be considered data gaps that would need to be addressed in a baseline level assessment. Even so, nearly all analytes would potentially present ecological risks, and most maximum concentrations are elevated above native soils.

Table 1: Summary Statistics for Surface Water Total Recoverable Data and Screening Level Results

Analytes	Total Hardness	Al-T	As-T	Ba-T	B-T	Cd -T	Cr-T	Cu -T	Fe-T	Pb -T	Mn-T	Mo-T	Ni -T	Se -T	Sr-T	Tl-T	V-T	Zn-T
Sample size	92	104	104	104	104	78	78	78	104	78	104	104	78	104	104	78	104	78
Number of Detected Values		97	3	104	93	0	0	19	104	9	104	27	0	5	77	0	41	12
Maximum BKG*	54	6.46	0.0051	0.113	0.186	0.00053	0.01	0.0102	8.49	0.005	2.57	0.0033	0.04	0.0044	0.562	0.0091	0.0123	0.0377
Maximum Site*	146.3	3.98	0.0098	0.247	1.82	0.00053	0.01	0.02	45.4	0.0032	0.808	0.123	0.04	0.0056	0.567	0.0019	0.0129	0.06
EPA CCC (mg/L)	NA	0.087	0.15	NA	NA	0.0004	0.118	0.013	1	0.0052	NA	NA	0.072	0.005	NA	NA	NA	0.165
Number of BKG Samples>EPA CCC		41	0	NV	NV	26	0	0	45	0	NV	NV	0	0	NV	NV	NV	0
Number of Site Samples>EPA CCC		43	0	NV	NV	26	0	1	46	0	NV	NV	0	1	NV	NV	NV	0
Conclusions		COPEC	<SL	COPEC No SL	COPEC No SL	COPEC All ND	<SL All ND	COPEC	COPEC	<SL	COPEC No SL	COPEC No SL	<SL All ND	COPEC	COPEC No SL	COPEC No SL	COPEC No SL	<SL

Notes:

1) * - For hardness, the minimum is shown
2) A water effects ratio of 1 was assumed
3) The minimum site hardness was used for hardness dependent metals; risk should be calculated on a sample by sample basis
4) Shading indicates hardness dependent metals
5) Data are in mg/L
6) Hardness was estimated as the sum of magnesium hardness and calcium hardness

Abbreviations:

1) COPEC - Contaminant of Potential Ecological Concern to be further evaluated in a baseline risk assessment
2) RLs>SLs - The reporting limits exceed the screening level and the data are all non-detect
3) All ND - The data are all non-detect
4) <SL - the maximum value is less than the screening level
5) EPA CCC - U.S. Environmental Protection Agency Chronic Criterion Continuous Concentration

Source:

http://water.epa.gov/scitech/swguidance/standards/current/upload/nrwqc-2009.pdf

Table 2: Summary Statistics for Surface Water Dissolved Data and Screening Level Results

Analytes	**Total Hardness**	**As-D**	**Cd-D**	**Cr-D**	**Cu-D**	**Fe-D**	**Pb-D**	**Mn-D**	**Ni-D**	**Se-D**	**Zn-D**
Sample size	92	104	78	78	78	26	78	26	78	104	78
Number of Detected Values		1	0	0	20	25	0	26	0	4	1
Maximum BKG*	54	0.0036	0.00053	0.01	0.0084	1.3	0.003	0.341	0.04	0.0041	0.0213
Maximum Site*	146.3	0.0048	0.00053	0.01	0.0052	5.69	0.003	0.345	0.04	0.0043	0.02
EPA CCC (mg/L)	NA	0.15	0.00032	0.10	0.012	1.00	0.004	NA	0.07	0.005	0.16
Number of BKG Samples>EPA CCC		0	39	0	0	5	0	NV	0	0	0
Number of Site Samples>EPA CCC		0	39	0	0	2	0	NV	0	0	0
Conclusions		<SL	COPEC RLS>SL	<SL All ND	<SL	COPEC	<SL All ND	COPEC No SL	<SL	<SL	<SL

Notes:
1) * - For hardness, the minimum is shown
2) A water effects ratio of 1 was assumed
3) The minimum site hardness was used for hardness dependent metals; risk should be calculated on a sample by sample basis
Shading indicates hardness dependent metals
Data are in mg/L
Hardness was estimated as the sum of magnesium hardness and calcium hardness

Abbreviations:
COPEC - Contaminant of Potential Ecological Concern to be further evaluated in a baseline risk assessment
RLs>SLs - The reporting limits exceed the screening level and the data are all non-detect
All ND - The data are all non-detect
<SL - the maximum value is less than the screening level
BKG - Background
EPA CCC - U.S. Environmental Protection Agency Chronic Criterion Continuous Concentration

Source:
http://water.epa.gov/scitech/swguidance/standards/current/upload/nrwqc-2009.pdf

Table 3: Summary of Sediment Data and Screening Level Results

Analytes	ALUMINUM	ARSENIC	BARIUM	BORON	CADMIUM	CHROMIUM	COPPER	IRON	LEAD
Total n, number ND	30	30	30	30	30	30	30	30	30
Number of Detected Values	30	26	30	4	0	30	24	30	30
Maximum BKG*	3.33E+03	5.90E+00	5.01E+01	2.93E+01	7.30E-01	1.19E+01	1.33E+01	1.19E+04	4.25E+01
Maximum Site*	1.95E+04	5.78E+01	2.60E+02	1.05E+02	2.60E+00	3.40E+01	4.62E+01	9.60E+04	4.65E+01
SQC for Benthic Life	5.80E+04	5.90E+00	NA	NA	5.92E-01	2.60E+01	1.60E+01	2.00E+04	2.00E-01
Number of BKG Samples>SL	0	1	NV	NV	4	0	1	1	5
Number of Site Samples>SL	0	16	NV	NV	24	4	10	12	24
Conclusion	<SL	COPEC	COPEC No SL	COPEC No SL	COPEC	COPEC	COPEC	COPEC	COPEC

Analytes	MANGANESE	MOLYBDENUM	NICKEL	SELENIUM	STRONTIUM	THALLIUM	URANIUM-TOTAL	VANADIUM	ZINC
Total n, number ND	30	30	30	30	30	30	8	30	30
Number of Detected Values	30	6	13	27	13	0	8	27	30
Maximum BKG*	2.28E+02	3.70E+00	5.90E+00	1.40E+00	1.46E+01	1.40E+00	1.60E-01	1.47E+01	5.38E+01
Maximum Site*	1.13E+03	1.64E+01	2.68E+01	9.30E+00	9.78E+01	5.20E+00	9.00E-01	7.69E+01	1.89E+02
SQC for Benthic Life	4.60E+02	NA	1.59E+01	2.00E+00	NA	NA	NA	NA	1.20E+02
Number of BKG Samples>SL	0	NV	1	1	NV	NV	NV	NV	1
Number of Site Samples>SL	3	NV	6	16	NV	NV	NV	NV	8
Conclusion	COPEC	COPEC No SL	COPEC	COPEC	COPEC No SL	COPEC No SL	COPEC No SL	COPEC No SL	COPEC

Notes:
The SQC for benthic life is the minimum value from the Ecological Benchmark Took
SQC – Sediment quality criterion

Table 4: Summary of Yard 520 CCB and Screening Level Results

Location ID			GP001	GP002	GP002	GP003	Soil Screening Level (mg/kg)
Sample Date			9/20/2005	9/20/2005	9/20/2005	9/20/2005	
Depth Interval (feet)			8- 12	12- 16	12- 16	8- 12	
Sample Type			Sample	Sample	Duplicate	Sample	
CAS No.	Chemical Name	Units					
7429-90-5	ALUMINUM	mg/kg	**2420**	**14500**	**13400**	**21000**	50
7440-36-0	ANTIMONY	mg/kg	190 J-	5.7 UJ	5.8 UJ	9.2 J-	NA
7440-38-2	ARSENIC	mg/kg	0.63 U	**529 J+**	**411 J+**	**210 J+**	5.7
7440-39-3	BARIUM	mg/kg	**90.3**	**112**	**86.6**	**157**	1.04
7440-41-7	BERYLLIUM	mg/kg	0.03 U	1.4	1.2	0.74	NA
7440-42-8	BORON	mg/kg	**28.7 UJ**	**321**	**209**	**922**	0.5
7440-43-9	CADMIUM	mg/kg	**2.5 J+**	**4.1 J+**	**3.6 J+**	**5.2 J+**	0.00222
7440-70-2	CALCIUM	mg/kg	113000	3630	3520	8360	NA
7440-47-3	CHROMIUM	mg/kg	**6270**	**60.6**	**52.3**	**165**	0.4
7440-48-4	COBALT	mg/kg	6.8 J	14.2	12.4	16.3	NA
7440-50-8	COPPER	mg/kg	**130**	**65.3**	**56**	**71.8**	5.4
7439-89-6	IRON	mg/kg	**187000**	**47300**	**42900**	**44600**	200
7439-92-1	LEAD	mg/kg	**78.8 J+**	**312 J+**	**251 J+**	**139 J+**	0.0537
7439-95-4	MAGNESIUM	mg/kg	2880	1200	1110	1360	NA
7439-96-5	MANGANESE	mg/kg	**994**	60.7	56.3	86.1	100
7439-97-6	MERCURY	mg/kg	0.29	0.15	0.12	0.04	0.1
7439-98-7	MOLYBDENUM	mg/kg	**13.8 J+**	**12.7 J+**	**12.7 J+**	**69.5 J+**	2
7440-02-0	NICKEL	mg/kg	**89.5**	**66.5**	**56**	**70.6**	13.6
7440-09-7	POTASSIUM	mg/kg	169 J	2610	2210	3140	NA
7782-49-2	SELENIUM	mg/kg	**6.2 J+**	**6.3 J+**	**6.2 J+**	**9.7 J+**	0.0276
7440-21-3	SILICON	mg/kg	920 J-	915 J-	895 J-	1170 J-	NA
7440-22-4	SILVER	mg/kg	0.17 U	0.1 U	0.18 J	0.11 U	NA
7440-23-5	SODIUM	mg/kg	159 J+	660 J+	560 J+	1410 J+	NA
7440-34-9	SULFUR	mg/kg	**33700**	**397**	**441**	**635**	2
7440-28-0	THALLIUM	mg/kg	**0.24 UJ**	**10 J-**	**8.6 J-**	**8.1 J-**	0.0569
7440-62-2	VANADIUM	mg/kg	**2.2 U**	**85.2 J+**	**62.7 J+**	**194 J+**	1.59
7440-66-6	ZINC	mg/kg	627	496	403	576	6.62

Notes:
1) Bold shaded values indicate samples where the detected value or reporting limit exceeded conservative screening levels.
2) Screening values are the minimum value for soils from the Ecological Benchmark Tool. These do not always include values for birds and/or mammals.

Table 5. Trench CCB Soil Samples and Screening Level Results (Page 1)

Location ID	**7429-90-5**	**7440-36-0**	**7440-38**	**7440-39-3**	**7440-41-7**	**7440-42-8**	**7440-43-9**	**7440-70-2**	**7440-47-3**	**18540-29-9**
Analytes	**ALUMINUM**	**ANTIMONY**	**ARSENIC**	**BARIUM**	**BERYLLIUM**	**BORON**	**CADMIUM**	**CALCIUM**	**CHROMIUM**	**CHROMIUM, HEXAVALENT**
Background n	13	13	13	13	13	13	13	13	13	0
Site n	37	37	37	37	37	37	37	37	37	13
Maximum BKG	14300	2.7	32.8	110	1.6	54.3	1.7	20400	37.6	0
Maximum Site*	44600	2.9	97.2	355	5.6	151	4.3	44400	166	1.95
ESV (mg/kg) (Minimum RAIS see below)	50	0.142	5.7	1.04	1.06	0.5	0.00222	NV	26	0.4
Number of BKG Samples>ESV	13	13	3	13	1	13	13	0	1	NA
Number of Site Samples>ESV	37	37	35	37	33	37	37	0	36	13
Sample Detection Frequency	100%	0%	77%	100%	23%	23%	46%	100%	100%	NA
Site Sample Detection Frequency	100%	0%	100%	100%	97%	97%	100%	100%	100%	92%
Conclusions	COPEC	COPEC	COPEC	COPEC	COPEC	COPEC	COPEC	Unknown	COPEC	COPEC
	Site>BKG	Site>BKG; All ND	Site>BKG	Site>BKG	Site>BKG	Site>BKG	Site>BKG	No ESV; compare to MDL	Site>BKG	No BKG
	>ESV	Address RL in UA	>ESV	>ESV	>ESV	>ESV	>ESV	>BKG	>ESV	>ESV

Table 5. Trench CCB Soil Samples and Screening Level Results (Page 2)

Location ID	**7440-48-4**	**7440-50-8**	**7439-89-6**	**7439-92-1**	**7439-95-4**	**7439-96-5**	**7439-97-6**	**7439-98-7**	**7440-02-0**
Analytes	**COBALT**	**COPPER**	**IRON**	**LEAD**	**MAGNESIUM**	**MANGANESE**	**MERCURY**	**MOLYBDENUM**	**NICKEL**
Background n	13	13	13	13	13	13	13	13	13
Site n	37	37	37	37	37	37	37	37	37
Maximum BKG	6.7	19.7	29900	45.3	6360	554	0.05	8.9	20.6
Maximum Site*	19.5	42.1	142000	117	9500	737	0.06	13.2	50.7
ESV (mg/kg) (Minimum RAIS see below)	0.14	5.4	200	0.0537	NV	100	0.1	2	13.6
Number of BKG Samples>ESV	13	2	13	13	0	2	0	3	1
Number of Site Samples>ESV	37	36	37	37	0	31	0	32	36
Sample Detection Frequency	38%	23%	100%	85%	100%	100%	46%	31%	54%
Site Sample Detection Frequency	100%	100%	100%	100%	100%	100%	92%	97%	100%
Conclusions	COPEC	COPEC	COPEC	COPEC	Unknown	COPEC	COPEC	COPEC	COPEC
	Site>BKG	Site>BKG	Site>BKG	Site>BKG	No ESV; compare to MDL	Site>BKG	Site>BKG	Site>BKG	Site>BKG
	>ESV	>ESV	>ESV	>ESV	>BKG	>ESV	<ESV for inverts, but BCC	>ESV	>ESV

Table 5: Trench CCB Soil Samples and Screening Level Results (Page 3)

Location ID	**7440-02-0**	**7440-09-7**	**7782-49-2**	**7440-21-3**	**7440-22-4**	**7440-23-5**	**7704-34-9**	**7440-28-0**	**7440-62-2**	**7440-66-6**
Analytes	**NICKEL**	**POTASSIUM**	**SELENIUM**	**Silicon**	**SILVER**	**SODIUM**	**SULFUR**	**THALLIUM**	**VANADIUM**	**ZINC**
Background n	13	13	13	13	13	13	13	13	13	13
Site n	37	37	37	37	37	37	37	37	37	37
Maximum BKG	20.6	2080	3.7	2770	0.65	9970	4350	2	54.9	94.9
Maximum Site*	50.7	8760	3.5	3500	0.15	1310	514	5	90.4	255
ESV (mg/kg) (Minimum RAIS see below)	13.6	100	0.0276	NV	2	NV	2	0.0569	1.59	6.62
Number of BKG Samples>ESV	1	13	13	0	0	0	13	13	13	5
Number of Site Samples>ESV	36	37	37	0	0	0	37	37	37	37
Sample Detection Frequency	54%	100%	0%	100%	0%	62%	38%	8%	100%	100%
Site Sample Detection Frequency	100%	100%	46%	100%	0%	100%	95%	57%	100%	100%
Conclusions	COPEC	Unknown	COPEC	Unknown	Not COPEC	Unknown	COPEC	COPEC	COPEC	COPEC
	Site>BKG	No ESV; compare to MDL	BKG all ND w/ elevated RL	Site < 2x BKG	Site<BKG	Site<BKG	Site<BKG	Site>BKG	Site>BKG	Site>BKG
	>ESV	>BKG	>ESV	No ESV	All ND, <ESV	Use MDL as ESV	>ESV	>ESV	>ESV	>ESV

Notes:

1) All analytes that are greater than (>) the ESV should be considered COPECs & carried forward into a baseline ERA

2) MDLs should be obtained and compared to nutrients before dropping from evaluation

3) Boxplots or other statistical evaluation of site data should be compared to background in the baseline ERA prior to dropping as a COPEC because lower than background

4) If all ND, should discuss RLs in uncertainty analysis

5) Before "screening out" any COPECs, the SERA should verify that all screening values include higher trophic level values, and that all BCCs are carried forward.

6) Road base sample not included

7) This analysis is a maximum screening evaluation; UCL95s were not calculated and used at this point.

Abbreviations:

1) ESV - Ecological Screening value; minimum from Ecological Benchmark Tool

2) BKG – Native Soils; Assumed to be Background but data should be provided to support this

3) Address RL in UA - Reporting limits exceed ESVs, cannot evaluate risk, address in Uncertainty Analysis

4) MDL - Minimum daily requirement for birds and mammals should be obtained and used for ESV

5) Inverts - Invertebrates

6) BCC - Bioaccumulative Contaminant of Concern

Table 6: Data Supporting the Screening Level Benchmarks (Page 1)

Analyte	CAS Number	Dutch Intervention Soil Screening Benchmark mg/kg*	Dutch Target Soil Screening Benchmark mg/kg	Eco-SSL Avian Soil Screening Benchmark mg/kg	Eco-SSL Inverts Soil Screening Benchmark mg/kg	Eco-SSL Mammalian Soil Screening Benchmark mg/kg	Eco-SSL Plants Soil Screening Benchmark mg/kg	EPA R6 Earthworms Surface Soil Screening Benchmark mg/kg
Aluminum	7429-90-5							
Antimony (metallic)	7440-36-0	2900	3		78	0.27		
Arsenic, Inorganic	7440-38-2	40	29	43		46	18	60
Barium	7440-39-3	625	160		330	2000		
Beryllium and compounds	7440-41-7	29	1.1		40	21		
Boron / Borates Only	7440-42-8							
Cadmium (Diet)	7440-43-9	12	0.8	0.77	140	0.36	32	110
Calcium	7440-70-2							
Chromium(III), Insoluble Salts	16065-83-1			26		34		
Chromium(VI)	18540-29-9					130		
Chromium, Total	16065-83-1	230	100					0.4
Cobalt	7440-48-4	240	9	120		230	13	
Copper	7440-50-8	190	36	28	80	49	70	61
Iron	7439-89-6							
Lead and Compounds	7439-92-1	290	85	11	1700	56	120	500
Magnesium	7439-95-4							
Manganese (Non-diet)	7439-96-5			4300	450	4000	220	
Mercury (elemental)	7439-97-6	10	0.3					0.1
Molybdenum	7439-98-7	480	3					
Nickel Soluble Salts	7440-02-0	210	35	210	280	130	38	200
Potassium	7440-09-7							
Selenium	7782-49-2	5	0.7	1.2	4.1	0.63	0.52	70
Silver	7440-22-4	15		4.2		14	560	
Sodium	7440-23-5							
Sulfur	7704-34-9							
Thallium (Soluble Salts)	7440-28-0	14	1					
Vanadium Pentoxide	1314-62-1							
Vanadium	7440-62-2	250	42	7.8		280		
Zinc (Metallic)	7440-66-6	720	140	46	120	79	160	120

Table 6: Data Supporting the Screening Level Benchmarks (Page 2)

Analyte	CAS Number	EPA R6 Plants Surface Soil Screening Benchmark mg/kg	ORNL Invertebrates Soil Screening Benchmark mg/kg	ORNL Microbes Soil Screening Benchmark mg/kg	ORNL Plants Screening Benchmark mg/kg	SO EPA R4 Soil Screening Benchmark mg/kg	SO EPA R5 ESL Soil Screening Benchmark mg/kg	Minimum
Aluminum	7429-90-5	50		600	50	50		**50**
Antimony (metallic)	7440-36-0	5			5	3.5	0.142	**0.142**
Arsenic, Inorganic	7440-38-2	37	60	100	10	10	5.7	**5.7**
Barium	7440-39-3	500		3000	500	165	1.04	**1.04**
Beryllium and compounds	7440-41-7	10			10	1.1	1.06	**1.06**
Boron / Borates Only	7440-42-8	0.5		20	0.5	0.5		**0.5**
Cadmium (Diet)	7440-43-9	29	20	20	4	1.6	0.00222	**0.00222**
Calcium	7440-70-2							**0**
Chromium(III), Insoluble Salts	16065-83-1							**26**
Chromium(VI)	18540-29-9		0.4		1			**0.4**
Chromium, Total	16065-83-1	5	0.4	10	1	0.4	0.4	**0.4**
Cobalt	7440-48-4	20		1000	20	20	0.14	**0.14**
Copper	7440-50-8	100	50	100	100	40	5.4	**5.4**
Iron	7439-89-6			200		200		**200**
Lead and Compounds	7439-92-1	50	500	900	50	50	0.0537	**0.0537**
Magnesium	7439-95-4							**0**
Manganese (Non-diet)	7439-96-5	500		100	500	100		**100**
Mercury (elemental)	7439-97-6	0.3	0.1	30	0.3	0.1	0.1	**0.1**
Molybdenum	7439-98-7	2		200	2	2		**2**
Nickel Soluble Salts	7440-02-0	30	200	90	30	30	13.6	**13.6**
Potassium	7440-09-7							**0**
Selenium	7782-49-2	1	70	100	1	0.81	0.0276	**0.0276**
Silver	7440-22-4	2		50	2	2	4.04	**2**
Sodium	7440-23-5							**0**
Sulfur	7704-34-9					2		**2**
Thallium (Soluble Salts)	7440-28-0	1			1	1	0.0569	**0.0569**
Vanadium Pentoxide	1314-62-1							**0**
Vanadium	7440-62-2	2		20	2	2	1.59	**1.59**
Zinc (Metallic)	7440-66-6	190	100	100	50	50	6.62	**6.62**

Figure 1: Maximum Concentrations of Some COPECs in Surface Water by Location (mg/L)